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54 Bill handling apparatus.

57 In a bill deposit and dispense apparatus received bills are automatically discriminated for truth or falsehood and are stored in boxes in accordance with their denominations. The stored bills are selectively fed out and dispensed for payment.

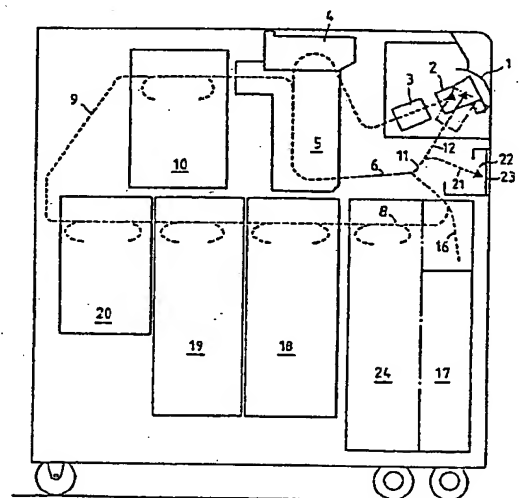


FIG. 1

EP 0 317 537 A2

## Description

### BILL HANDLING APPARATUS

#### A. Field of the Invention

The present invention is related to a circulation-type bill deposit and dispense apparatus which is used in a financial agency like a bank, in particular, a bill deposit and dispense apparatus wherein the received bills are stored in storage boxes (stackers) for their respective denominations after they are automatically discriminated for truth or falsehood, and the bills in the storage boxes are selectively fed out and dispensed for payment.

#### B. Prior Art

In the circulation-type bill deposit and dispense apparatus as described above, it is required to have a function of collectively loading or collectively unloading bills. The laid-open Patent Application No. 33757/1981 discloses a circulation-type bill deposit and dispense apparatus having such a function. That is, the apparatus is provided with a removable collective storage box capable of storing bills of any denomination in addition to the storage boxes for the respective denominations, and has a collective loading function wherein the collective storage box containing bills of each denomination for payment is mounted on the body of the apparatus at the start of the business and those bills are sequentially fed out, discriminated with respect to their denomination and stored in the corresponding storage boxes for the different denominations, and a collective unloading function wherein the bills in each storage box for the different denominations are fed out and stored in the collective storage box through careful examination.

#### C. Problems to be Solved by the Invention

Usually, in a circulation-type bill deposit and dispense apparatus, it is required to feed bills at a high speed. However, the edges of bills come in contact with fixed objects such as the side walls of the feed path, which may cause a feed jam. To prevent this, the width of the feed path is increased and the bills are fed being held with rollers or belts. However, in this kind of bill feed mechanism, skid or side slip can easily occur in the feed path when the bills are fed out one by one from a stack of bills, and in addition, it is inevitable from the structure thereof that when the bills being fed at a high speed are released into a free space and stacked (for example, in an escrow or a stacker), the bills tend to skid in the longitudinal direction thereof.

This skid can be restricted to some extent by the side walls of the storage box but, if the spacing between the side walls is not made large enough, jams will occur easily. Accordingly, the width of the storage box is made considerably larger than that of bills. Therefore, the bills fed out from such a storage box are shifting in the lateral direction, and, when these are collectively loaded or unloaded, feed jams, failure of denomination discrimination, or stacking jams in the storage box can occur easily.

The object of the present invention is to provide a circulation-type bill deposit and dispense apparatus in which feed failure and discrimination failure due to such skid of the bills are prevented.

#### D. Brief Description of the Drawings

Fig. 1 is a block diagram of the bill deposit and dispense apparatus incorporating the present invention,

Fig. 2 is a perspective view showing the shifting mechanism,

Fig. 3A is a perspective view showing the inverse shifting mechanism,

Fig. 3B is a plane view of the cam mechanism portion in the inverse shifting mechanism, and

Fig. 3C is a side view of said cam mechanism portion.

#### E. Means for Solving the Problems

In the present invention, the above described problems are solved by providing the following mechanisms in the circulation-type bill deposit and dispense apparatus.

(1) By providing a shifting mechanism for moving bills to be fed for discrimination of truth or falsehood at the time of receiving the bills to be fed for discrimination of denomination at the time of collective loading or collective unloading to a predetermined position of the left or right side with respect to the feed direction so as to eliminate dispersion of bills in the lateral direction, errors in discrimination of truth or falsehood or in discrimination of denominations and later feed jams are prevented.

(2) By providing an inverse shifting mechanism for moving bills to be shifted again, for example, the bills to be re-discriminated or the bills fed out from the storage box for collective loading or collective unloading to the side opposite to said shifting with respect to the feed direction by a predetermined amount, the subsequent errorless shifting operation is enabled.

#### F. Embodiment

Fig. 1 shows a block diagram of the circulation-type bill deposit and dispense apparatus incorporating the present invention, and with reference to this, the bill deposit operation, bill dispense operation, collective unloading operation and collective loading operation will be described.

##### (a) Bill deposit operation

In bill depositing, a shutter 1 opens, bills to be deposited are introduced by the operator into a bill receive and return box 2. Then, those bills are collectively sent into a feeder box 3, from which they are fed out one by one. Each bill fed out in this way is shifted by a shifting mechanism 4 to the predetermined left side with respect to the feed direction.

Accordingly, when sent to the next bill discriminator mechanism 5, all the bills pass through the substantially same position in the width direction along the left side of the feed path regardless of denomination, so that accurate discrimination of truth or falsehood is possible. The bills which have been discriminated here as true are sent through feed paths 6, 7, 8, and 9 to a temporary reservoir or escrow 10, and reserved until that transaction is finished. The bills which have been discriminated as false and the abnormally fed bills (skew, double etc.) are returned through feed paths 6, 11, and 12 into the box 2 which is rotated downwardly to the return position. When the bills in the box 3 are all fed out, the box 2 rotates upward to the bill receiving position, and the bills therein are passed into the box 3 and fed out again for re-discrimination. However, the bills returned from the discriminator mechanism 5 through the feed paths 6, 11, and 12 to the box 2 tend to be skewed or skidded (side-slipped) to the right or left side with respect to the feed direction, and when the bills which side-slipped to the left are sent again to the shifting mechanism 4 from the box 3 for re-discrimination, if they are biased to the left beyond said predetermined side of the shifting mechanism, they can collide with the edge of the left side wall before they are shifted, and produce a jam. For this reason, an inverse shifting mechanism (not shown) provided in association with the box 2 causes the bills for re-discrimination to move to the right in the lateral direction by a predetermined distance, and then supplies them to the box 3. Thus, when they pass through the shifting mechanism 4 again, the shifting operation is completed without colliding with the edge of the left side wall. The bills which have been discriminated as true by re-discrimination, are sent to the escrow 10 to be temporarily reserved, whereas the bills which have been again discriminated as false are sent to the box 2, from which they are taken out by the operator. Incidentally, the number of re-discriminations may be varied by the program.

If there is no operator's direction to cancel the transaction, or if the transaction is completed, the bills reserved in the escrow 10 are sent again through feed path 15 to the discriminator mechanism 5 one by one to be discriminated for their denomination. The denomination discrimination is substantially the same operation as the discrimination of truth or falsehood, and the only difference is that the decision level is lower than the discrimination of truth or falsehood. In the denomination discrimination, the bills discriminated as unsuitable for reuse because they are damaged are sent through the feed paths 6, 7, and 16 to a box 17 for recovering damaged bills. The bills discriminated as reusable are sent to and stored in the storage boxes for the respective denominations, namely, a ten-thousand-yen bill stacker 18, a thousand-yen bill stacker 19 or a five-thousand-yen bill stacker 20 in accordance with the result of the denomination discrimination. If a direction to cancel the transaction is issued, the bills in the escrow 10 are all returned through the feed paths 15, 6, 11 and 12 to the box 2.

#### (b) Bill dispense operation

When a bill dispense command is given to this I/O unit from the host computer, the bills corresponding to the specified denominations and amounts are fed out from the corresponding stackers one by one and dispensed to a bill dispense portion 22 through the feed paths 9, 15, 6, 11 and 21. In feeding the bills to be dispensed, the denomination discrimination is performed in the discriminator mechanism 5, and the amount to be dispensed is checked on the basis of that. Also, a bill feed error such as double taking-out is checked. The bills in which any error was detected in these checks are put in the damaged bills recovery box 17 through the transporting paths 7 and 16. When the bills of the specified denominations and amounts are dispensed on the tray of the bill dispense portion 22, the gate 23 of the dispense port opens and the tray slants left or right so that the operator can easily take them out.

#### (c) Collective unloading operation

In the careful examination at the close of the business, the bills in the each stacker are sequentially fed out, passed through the feed paths 9, 15, 6, 11, and 12, and are stacked in the box 2 which has been moved to the return position. As stated above, since some of the bills stored in the stackers might have been caused skid in feed to the stackers after shifting to the left at the time of bill depositing, the bills stacked in the box 2 can be dispersed in the lateral direction. Therefore, when a predetermined quantity of bills are stacked, they are entirely shifted to the right by the inverse shifting mechanism and supplied to the feeder box 3, and then they are sent out one by one, shifted by the shifting mechanism 4, and discriminated by the discriminator mechanism 5 for their denominations. Further, all of those bills are stored in a cartridge 24 through the feed paths 6, 7, and 8. In this way, the quantity of bills in each stacker is checked and fully examined, and they are unloaded to the cartridge 24.

#### (d) Collective loading operation

Since, at the start of the business, all of the stackers are empty, it is necessary to load them with the bills for dispense. Thus, the operator mounts the cartridge 24 containing bills of each denomination on the body of the apparatus. In response to a loading command from the host computer, the apparatus feeds the bills in the cartridge 24 one by one, and stacks them in the box 2, which has been moved to the return position, through the feed paths 9, 15, 6, 11, and 12. As mentioned above, since these bills are shifted to the left when collectively unloaded and are stored in the cartridge 24 as they caused skid during the feeding, the bills stacked in the box 2 are dispersed in the lateral direction. Thus, when a predetermined quantity of bills are stacked, the entire stack is shifted to the right by the inverse shifting mechanism and supplied to the feeder box 3, and then they are sent out one by one, and discriminated for their denominations through the shifting mechanism 4 and the discriminator mechanism 5, and stored in the stackers corresponding to

the denominations. The bills of the various denominations can be automatically loaded in this way.

Now, the structure and operation of the shifting mechanism will be described with reference to Fig. 2. Any denomination of bills are fed in the direction parallel to its short side, and this shifting mechanism aligns the left side of each bill with a predetermined position, or performs the shifting, and feeds them. As shown, a feed roller 31 is provided, the surface of which is coated with urethane rubber having a small coefficient of friction. By feeding around this roller 31, the bill is provided with a firm stand so that it can withstand the force of the width direction which is applied at the time of shifting. A guide 33 is provided at the left end of the feed roller 31 with respect to the feed direction, and it serves as a wall against which a bill abuts when it is shifted. Around the upper half of the feed roller 31, there are provided two pairs of skew rollers 34 made of urethane rubber of having a high coefficient of friction. The rollers 34 are fixed so that, when a bill is fed around the roller 31, they rotate in contact with the bill thereby slanting with respect to the feed direction, so as to push the bill 32 toward the guide 33. That is, the skew rollers 34 are biased toward the guide 33 by a spring 35, and, when no bill is being fed by the feed roller 31, they rotate while slipping at a position (angle) at which the friction between each skew roller 34 and the feed roller 31 and the force of the spring 35 are balanced. Since the frictional force between the bill 32 sent to this shifting mechanism and the feed roller 31 is smaller than the frictional force between the bill 32 and the skew rollers 34, the bill 32 slips on the roller 31 toward the guide 33 due to the force of the spring 35 and, when it abuts against the guide 33, it is fed under that condition. Thus, the shifting has been performed.

Now, the structure and operation of the inverse shifting mechanism will be described. The inverse shifting mechanism is for shifting the fed bills by a predetermined amount in the direction opposite to the previously stated shifting direction, or to the left with respect to the feed direction, thereby preventing the bill from colliding with the front edge portion of the guide 33 (Fig. 2) when it is sent again into the shifting mechanism. In this embodiment, all of the bills stacked in the box 2 at the return position are first moved to the right in the lateral direction, and then supplied to the feeder box 3.

Figs. 3A to 3C illustrate the structure and operational principle of this inverse shifting mechanism. In the bill dispensing, the bills introduced in the bill receiving and return box 2 are stacked therein while abutting against the two stoppers 41, then the stoppers 41 are pressed down below the box 2 by lowering the upper belts 42 until they contact these bills, and simultaneously the bills in the box 2 are collectively forwarded into the feeder box 3 by driving the upper belts 42 and the lower belts 43. Then, the box 2 is rotated counterclockwise to the return position by driving with a motor 44 around a shaft 45, so that it can receive the bills conveyed by a feed belt 46 and stack them in it. When the bills are forwarded into the feeder box 3, a presser board 47 rises and presses the bills against feeder belts 48,

and simultaneously the feeder belts 48 are driven to cause the bills to be fed out one by one from the top one. The bills fed out in this way are shifted by the shifting mechanism, to the left with respect to the feed direction as described above.

On the other hand, the bills conveyed by the feed belt 46 at the time of collective loading or rediscrimination are forwarded by a roller 49 attached with a film, and a pinch roller 50, into the box 2 in the return position as shown by a chained line. These bills were all shifted to the left by the shifting mechanism, and they include those skewed and skidded in the later transportation. The inverse shifting achieved by the present invention is performed by rotating the box 2 existing at the return position clockwise to return the box 2 to the bill receiving position as shown by a solid line. As shown in Fig. 3C, since the box 2 is coupled to the shaft 45 by means of splines, the torque of the shaft 45 is transmitted thereto, but the box 2 can move freely along the axis of the shaft. The box 2 is provided with a bearing 51 in the side thereof, and is pressed by a spring 53 against a cam 52 fixed to the body of the apparatus. The cam 52 is formed so that it moves to the left when the box 2 is in the return position and moves to the right when the box 2 is in the bill receiving position. Therefore, the bills sent into the box 2 staying in the return position are inversely shifted by moving to the right due to the cam action between the bearing 51 and the cam 52 when the box 2 is rotated by the bill 44 to the bill receiving position. Fig. 3B and Fig. 3C show the box 2 in the bill receiving position by a solid line and in the return position by a chained line. Also, similarly to the above-mentioned shifting mechanism, a mechanism for performing the shifting in the direction opposite to the shifting by the shifting mechanism by using a roller may be provided as the inverse shifting mechanism in the feed path, for example, in a position right after passing through the discriminator mechanism. Also, by providing a feed belt running diagonally from the bill return port to the bill receiving port, the whole stack of bills in the return port can be sent obliquely. The inverse shifting may also be performed by increasing the width of the bill receiving port to receive the bills that have been circulated into the bill receiving port and pushing them from the left and right to a predetermined position to supply them to the feeder mechanism.

#### G. Effect

By providing a shifting mechanism to prevent the deviation of the bill position in the discriminator mechanism, the accurate discrimination of truth or falsehood is enabled, and by providing an inverse shifting mechanism a feed jam in the shifting mechanism is prevented, thus the automatic collective unloading, collective loading and re-discrimination of bills are enabled.

#### Claims

(1) A bill handling apparatus comprising  
 a feeder mechanism for receiving the introduced bills and feeding them out one by one,  
 a shifting mechanism for shifting the bills fed out from said feeder mechanism to one side with respect to the feed direction thereof, 5  
 a holder mechanism for receiving and holding bills supplied thereto,  
 a transfer mechanism for transferring the bills held in said holder mechanism to said feeder mechanism, 10  
 an inverse shifting mechanism for inversely shifting the bills transferred by said transfer mechanism by moving them to the side opposite to said one side by a predetermined distance, 15  
 a discriminator mechanism for discriminating truth or falsehood of the bills shifted by said shifting mechanism,  
 and a supply mechanism for supplying the bills discriminated as false by said discriminator mechanism to said holder mechanism. 20

(2) A bill handling apparatus comprising  
 a feeder mechanism for receiving the introduced bills and feeding them out one by one, 25  
 a shifting mechanism for shifting the bills fed out from said feeder mechanism to one side with respect to the feed direction thereof,  
 a holder mechanism for receiving and holding bills supplied thereto, 30  
 a transfer mechanism for transferring the bills held in said holder mechanism to said feeder mechanism,  
 an inverse shifting mechanism for inversely shifting the bills transferred by said transfer mechanism by moving them to the side opposite to said one side by a predetermined distance, 35  
 a discriminator mechanism for discriminating the denomination of the bills shifted by said shifting mechanism, 40  
 a first storage mechanism for storing the bills discriminated by said discriminator mechanism for each denomination,  
 a removable second storage mechanism having any denomination of bills stored therein, 45  
 and a second supply mechanism for supplying the bills stored in said storage mechanism to said holder mechanism.

(3) A bill handling apparatus comprising 50  
 a feeder mechanism for receiving the introduced bills and feeding them out one by one,  
 a shifting mechanism for shifting the bills fed out from said feeder mechanism to one side with respect to the feed direction thereof, 55  
 a holder mechanism for receiving and holding bills supplied thereto,  
 a transfer mechanism for transferring the bills held in said holder mechanism to said feeder mechanism, 60  
 an inverse shifting mechanism for inversely shifting the bills transferred by said transfer mechanism by moving them to the side opposite to said one side by a predetermined distance, 65

a discriminator mechanism for discriminating the denomination of the bills shifted by said shifting mechanism,  
 a third storage mechanism having each denomination of bills stored therein,  
 a third supply mechanism for supplying the bills stored in said third storage mechanism to said holder mechanism,  
 and a fourth storage mechanism for storing the bills discriminated by said discriminator mechanism. •

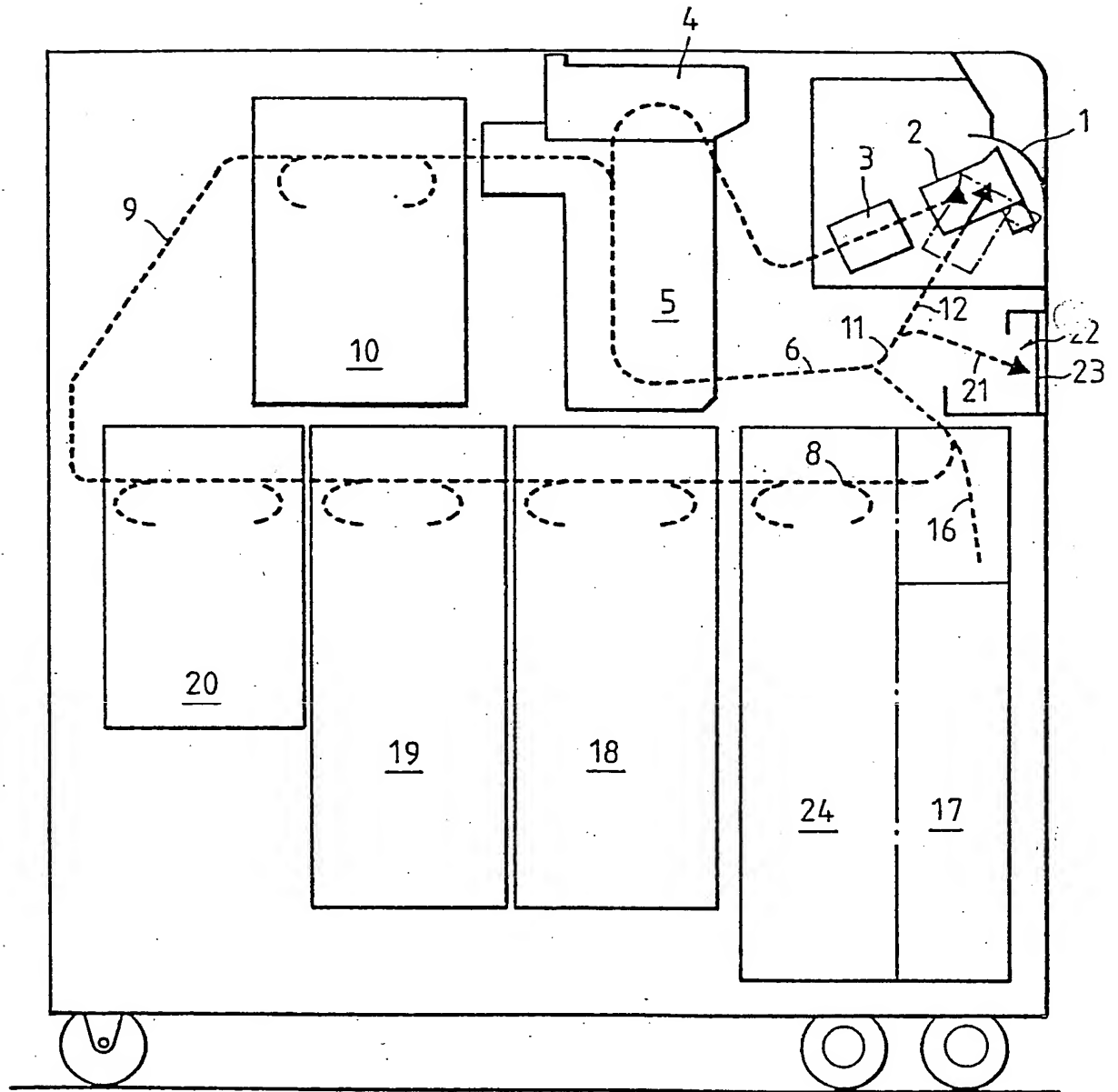


FIG. 1

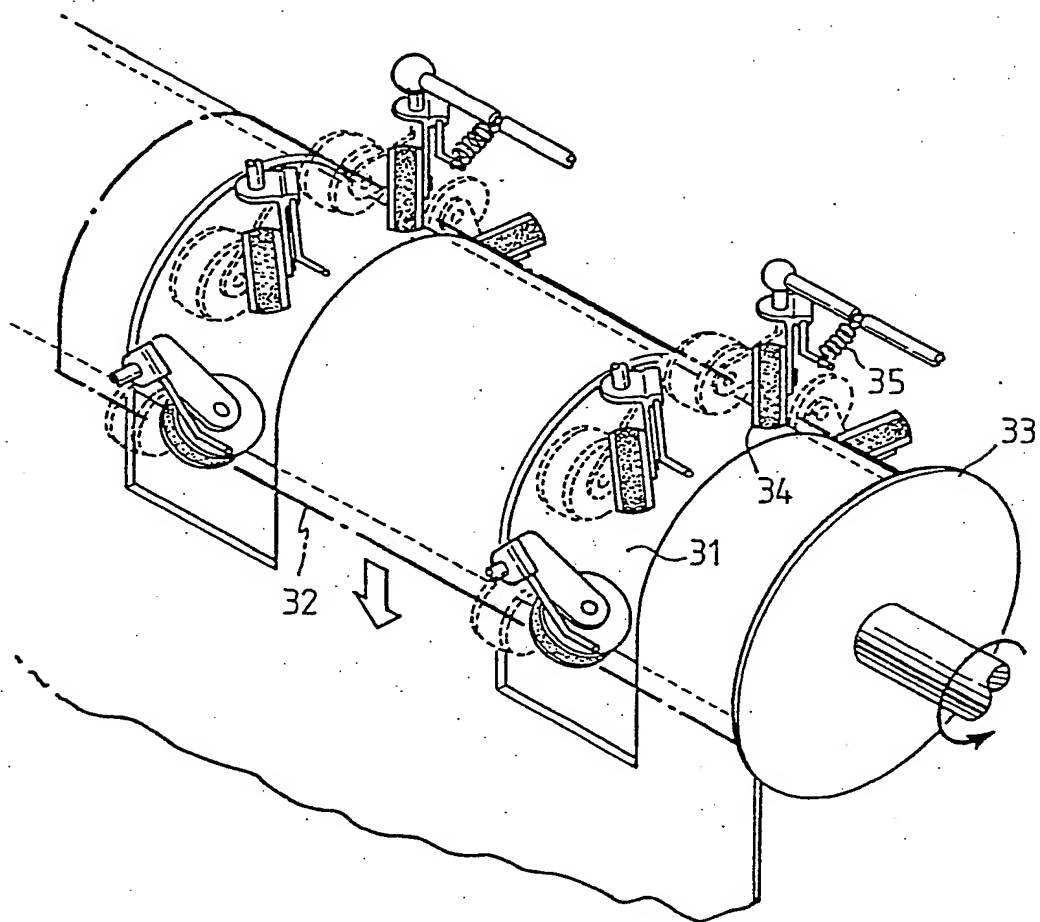


FIG. 2

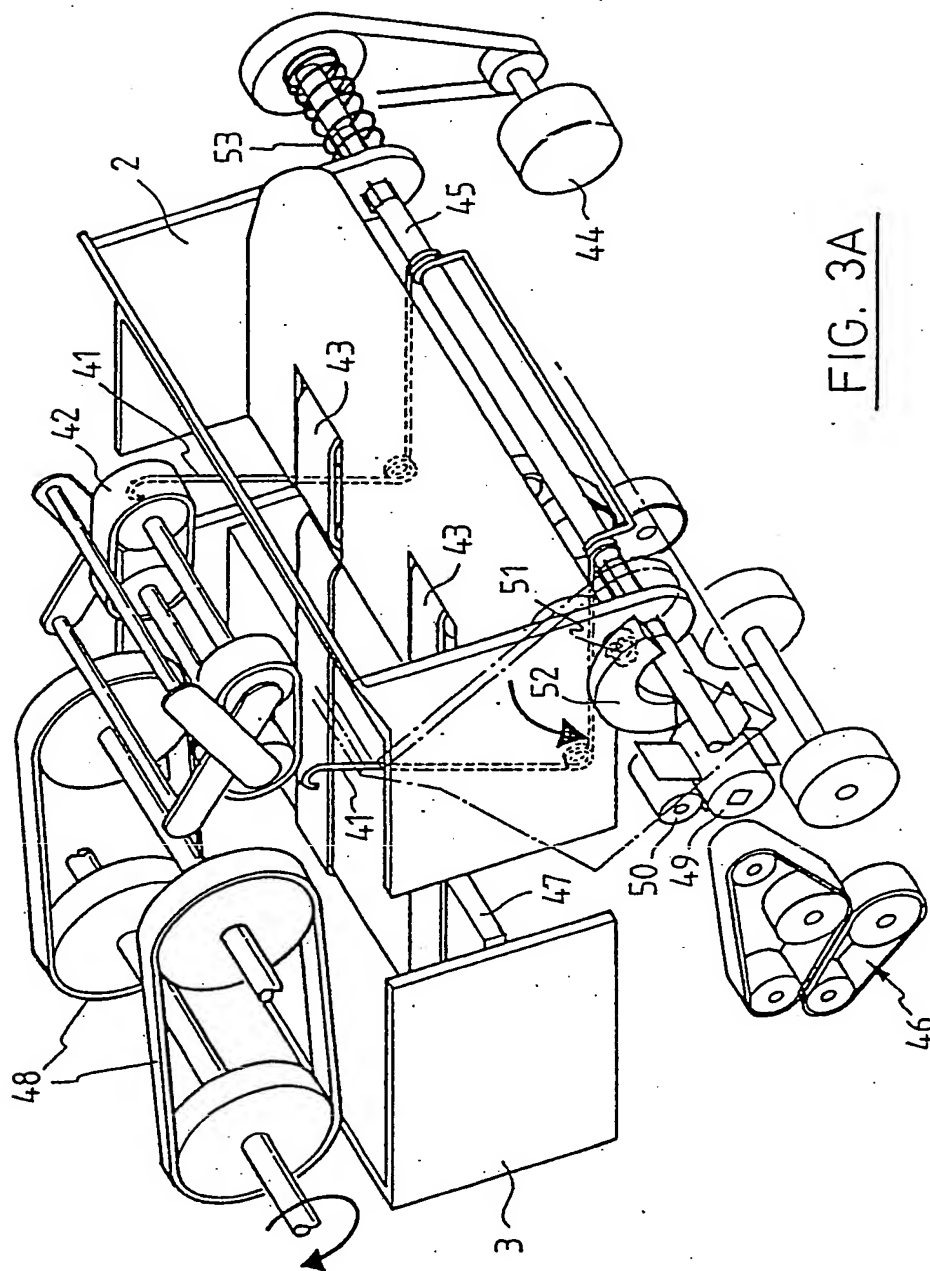


FIG. 3A



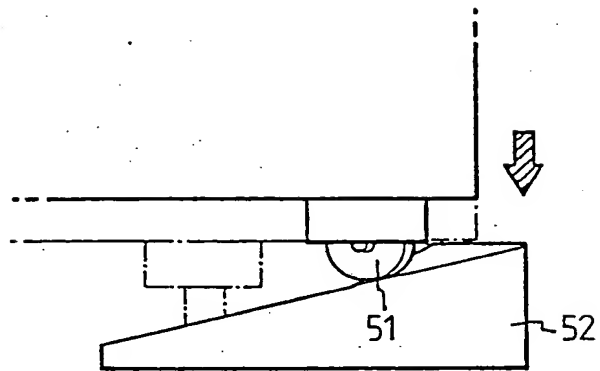


FIG. 3B

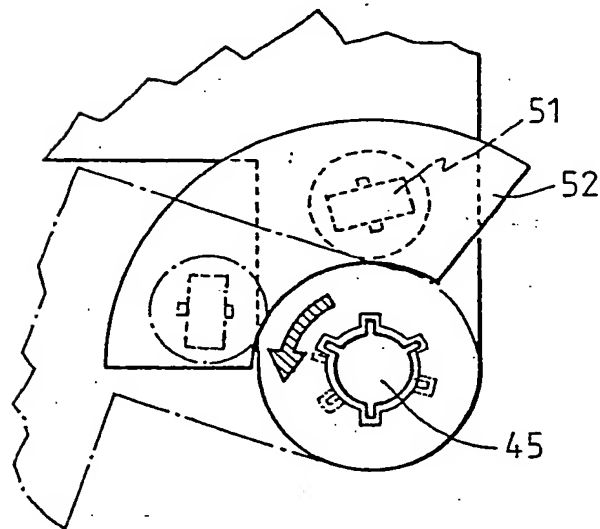


FIG. 3C